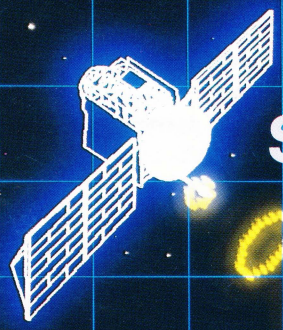
UNIVERSAL COUNTERS
SC-7204/7203/7202/7201
FREQUENCY COUNTERS
SC-7104/7103/7102/7101

IWATSU®



IWATSU

High-Reliability, Multiple-Function Universal Counters

Compact IWATSU Universal Counters allow frequencies as high as 1.3 GHz to be measured directly; for greater convenience they incorporate the facilities necessary to perform a wide range of computations. Their shielded cases give them a greater immunity to noise than conventional metal cases; their extermely high reliability is displayed by their remarkable MTBF values.

1.3 GHz SC-7204/SC-7203

MTBF 71,000 H (SC-7204)/79,000 H (SC-7203)

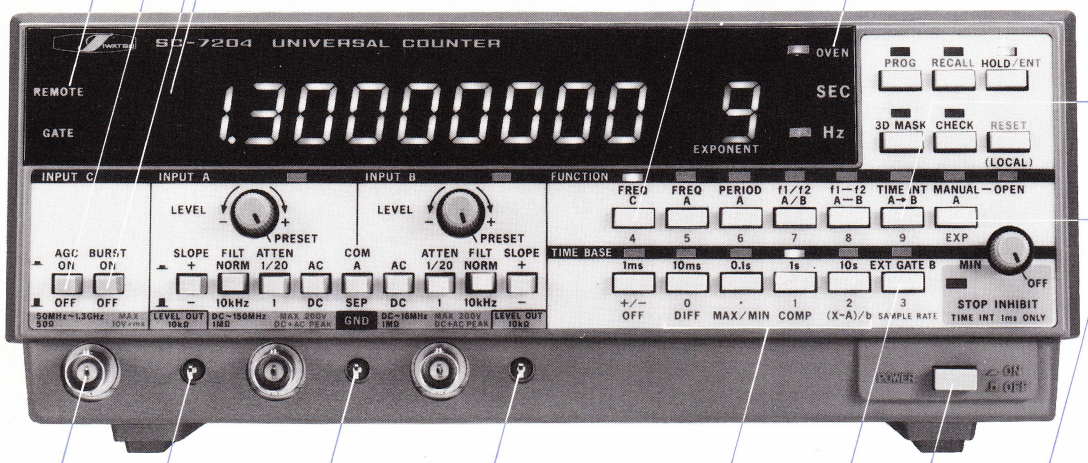
Remote control
Remote control is possible by incorporating the optional GP-IB or parallel I/O interface.

Built-in AGC circuit
The AGC amplifier has the wide dynamic range of approx. 40 dB.

Burst wave measuring function
Burst signals can be measured with one-touch operation.

Arithmetic operation display
Statuses in the arithmetic operation mode are displayed.

High-resolution frequency measurement
High frequencies up to 1.3 GHz can be measured easily with a resolution of 1 Hz.



Highly-stable reference oscillator
The oscillator is provided with a constant temperature chamber and has an aging rate of $\pm 3 \times 10^{-7}$/month, $\pm 10 \times 10^{-7}$/year (1 hour after switching power on).

High-resolution time interval measurement
The time interval can be measured with a resolution of up to 10 ps. To minimize measurement erros, the effective digits displayed are determined by the calculation of the square root of the number of measurements so as to stabilize measurement.

High-speed response in totalling measurement
Pulses with a pulsewidth as short as 3.3-ns can be tracked and measured.

Protection circuit using Schottky diode
The counter is practically maintenance-free, thanks to the super-fast electronic switches that are able to withstand high voltages (10 Vrms with 50-ohm signals).

Trigger level monitor terminals
The low-drift main amp backs up the trigger level monitor output with a max. drift of 0.5 mV/°C.

Wide variety of arithmetic operation functions
DIFF, MAX.MIN, COMP and (X-A)/b functions.

Sampling rate control
The sampling rate can be set digitally, from 0.1 to 9999 s (SC-7204/7203/7202. 0.2 s with SC-7201).

Self-checking function
All LEDs of all digits are lit when the power is switched on so that defects can be found. A built-in battery backs up the function, time-base and arithmetic operation constant memories.

Difference computation function (SC-7204/7203/7202/7201)

Press PROG → DIFF → ENT.
The value measured after RESET will be stored in internal memory as the reference value. It can be easily read out by RECALL, and the DIFF measurement can be continued by ENT.

Max/min value memory function (SC-7204/7203/7202)

Press PROG → MAX/MIN → ENT.
After measurement, each time RECALL is pressed H (max. value), L (min. value) and ⊓ (final value) can be monitored.
Pressing ENT resumes max/min measurement.
Updating only the max. or mix. value is also possible, in which case the other value can be recalled.

Digital comparator function (SC-7204/7203/7202)

Press PROG → COMP → ENT, then key-input H (higher limit) and press ENT, and key-input L (lower limit) and press ENT. Set values of H and L can be read out in sequence by RECALL. Pressing ENT resumes the COMP measurement.

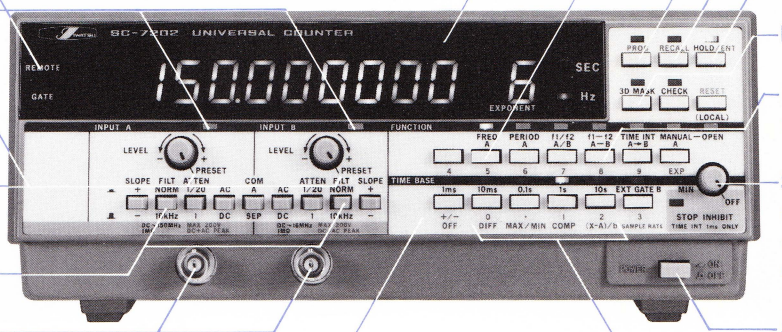
Subtraction/division function (SC-7204/7203/7202)

Press PROG → (X-A)/b → ENT, key-input constant A (subtracting value) and press ENT, then key-input constant b (dividing value) and press ENT.
After the above setting, the computed value will be displayed.
When arithmetic operations are impossible (for instance when b = 0), the status section displays E (error).
Constants A and b can be read out by pressing RECALL.
The (X-A)/b measurement is resumed by pressing ENT.

To stop arithmetic operations

Arithmetic modes are released by pressing PROG → OFF → ENT and replaced by the ordinary measurement mode.

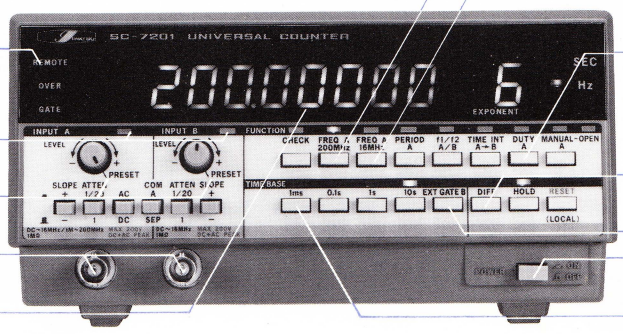
150 MHz SC-7202
MTBF 88,000 H



Remote control
Trigger indicator for easy triggering
High input sensitivity
Preset functions using wide-bandwidth, low-drift amplifier
10-kHz low pass filter provided as standard
Electronic protection circuit
Wide timebase from 1 ms to 10 s

Easy readout display with large, 15-mm high digits
High-resolution measurement (9-digit/s at 150 MHz)
Arithmetic operation switches
Masking function
Frequency difference measurement function
Stop/inhibit function to assist measurement of contact output signals containing chattering
Self-checking function
Arithmetic operation functions

200 MHz SC-7201
MTBF 112,000 H



Remote control possible
Trigger indicator for easy triggering
High input sensitivity
Electronic protection circuit
Easy readout with large LEDs

High-resolution measurement; 7 digits/s measurements possible in wide range up to 200 MHz
One-touch duty ratio measurement function
DIFF computation function
External gate-control possible
Self-checking fuction
1-ms timebase

Frequency Counters; Improved starting characteristics, high immunity to noise and remarkable MTBFs

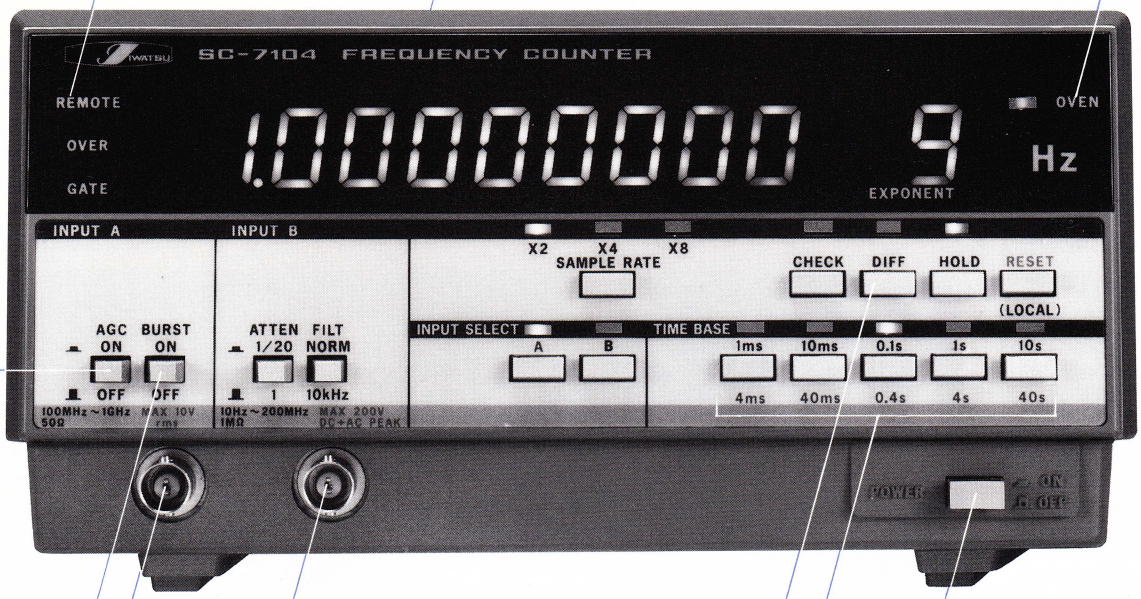
1000 MHz SC-7104

MTBF 114,000 H

Remote control
Remote control is possible by incorporating the optional GP-IB interface.

Low-power high-accuracy oscillator
The oscillator which supports the 1-GHz performance is covered by shielding material for higher reliability. This counter embodies IWATSU's long experience in the manufacture of counters.

Highly-stable reference oscillator
The reference oscillator has an aging rate of $\pm 2 \times 10^{-8}$/day, $\pm 10 \times 10^{-8}$/year. When the optional SC-0115 is used, this becomes $\pm 2 \times 10^{-9}$/day, $\pm 5 \times 10^{-8}$/year.



AGC circuit built in
The AGC amplifier has the wide dynamic range of approx. 40 dB.

Burst wave measuring function
Burst signals can be measured with a one-touche operation.

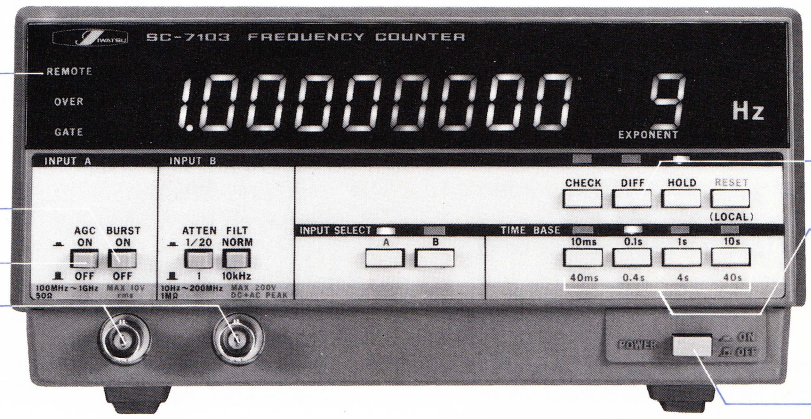
Electronic protection circuit
Failures are minimized because the input circuitry has the high input voltage allowance of 10 Vrms (50-Ω signal) and 200 V DC + AC peak (1-MΩ signal).

DIFF function
The difference from the reference value can be measured with one-touche operation.

Wide timebase range
This makes the range of possible measurements wider.

Self-checking function
All LEDs of all digits are lit when the power is switched on, so that defects can be found.

1000 MHz SC-7103
MTBF 128,000 H



Remote control possible

Burst wave measuring function

AGC circuit built in

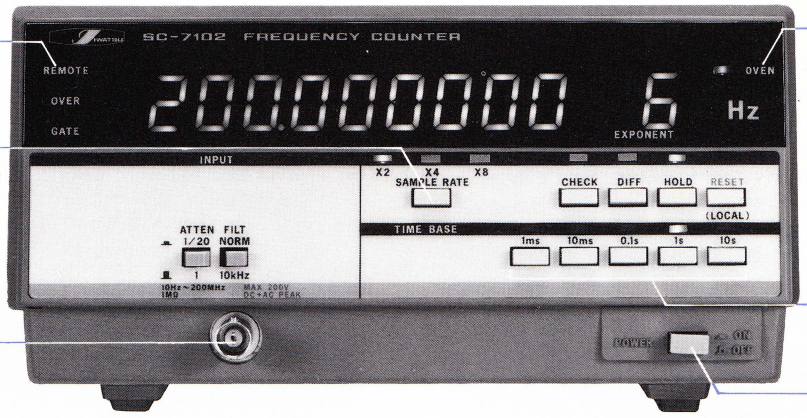
Electronic protection circuit
50-Ω signals: 10 Vrms,
1-MΩ signals: 200 V DC + AC peak.

DIFF function

1 GHz 1/4 prescaler
Measuring time is shortened.
10 Hz resolution/0.4 s.
1,00000000 9 Hz
9-digit mantissa Exponent

Self-checking function

200 MHz SC-7102
MTBF 135,000 H



Remote control possible

Highly-stable reference oscillator
$\pm 2 \times 10^{-8}$/day, $\pm 10 \times 10^{-8}$/year. Rise characteristic within $\pm 5 \times 10^{-8}$ (10 minutes after switching power on).

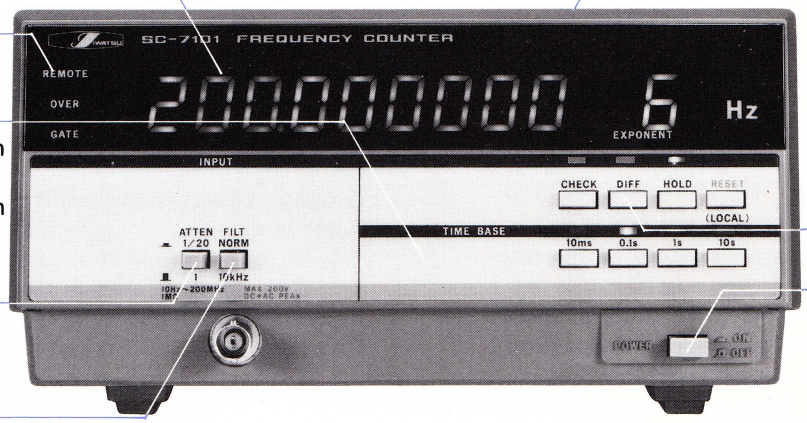
Sampling rate switch
Approx. 0.2 s for convenience in reading and switchable in four steps; x1, x2, x4 and x8.

Electronic protection circuit
1-MΩ signals: 200 V DC + AC peak.

Wide timebase range
1 ms to 10 s.

Self-checking function

200 MHz SC-7101
MTBF 150,000 H



Easy readout with 15-mm high digits

Remote control possible

High-speed, high-resolution measurement
Automatic switching between 9 digits/s (200 MHz) and 7 digits/s (low-frequencies from 10 Hz).

200-MHz Wide-band attenuator

10-kHz low-pass filter for high-resolution low-frequency measurement

Highly-stable reference oscillator
Measurement with an accuracy of $\pm 3 \times 10^{-6}$ is possible immediately after switching the power on. The max. aging rate is $\pm 3 \times 10^{-7}$/month, $\pm 10 \times 10^{-7}$/year.

DIFF function

Self-checking function

COUNTER OPTIONS

SC-0109 Parallel Interface
(for SC-7204/SC-7203/SC-7202)

By incorporating the SC-0109 in these Universal Counters, the following input/output functions are possible.

1. Data output
   Data printing using a Centronics-type printer or output to the parallel I/O port of a personal computer is possible.

2. Remote control input
   The measurement functions and timebase can be remote controlled by the signal input to the REMOTE connector. The remote control can be done simply by connecting a switch, etc. because both the function and timebase control inputs are 4-bit parallel.

3. Status output
   The measurement/computing status signal (4-bit with OVER, Hi-OUT, Lo-OUT and NORMAL) is output via the REMOTE connector. Because the status output is an open-collector output (TTL 7406, 10 kΩ PULL UP), it can be combined with the counter's COMP mode for a wide range of applications including external relay control according to the GO/NO-GO judgement, etc.

4. Data output control
   The number of data values per printed character can be set between 1 – 4 using the DIP switches on the rear panel. When the 4 data print/line mode is used with an 80-character/line printer, the entire width of the printing paper can be effectively used so that paper consumption can be cut. Data output can be inhibited according to the measurement/computing results so that, for example, only the Hi-OUT data in the COMP mode is printed.

5. External resetting
   External reset signal can be input via the DATA OUT connector pin 35 or REMOTE connector pin 10.
   The external reset signal is a negative pulse with a pulse-width of more than 1 μs, from which resetting is recognized by the negative-going edge.
   Internal processing requires 500 μs to 1 ms between recognized and actual resetting.
   The input signal level is TTL compatible. (CMOS 4049, 4050, 10 kΩ PULL UP).
   Resetting input during data output period is recognized after the completion of data output.

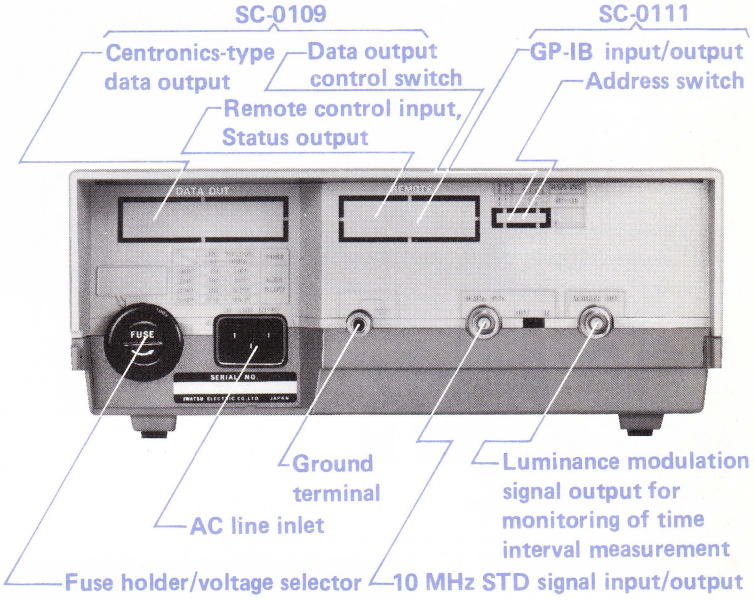
SC-0111 GP-IB Interface
(for SC-7104/SC-7203/SC-7202)

When incorporated in these counters, the SC-0111 makes possible the measurement resetting from an external controller, remote setting of measurement functions, timebase condition, arithmetic operations, and external transmission of data.

- The electrical and mechanical ratings comply with IEEE Std. 488-1978.
- The subset functions are SH1, AH1, T5, L4, SR1, RL1, PP0, DC1, DT1 and C0.
- The remote/local status can be confirmed from an LED display on the front panel.

Remote control functions
- Measurement function setting
- Timebase condition setting
- Measurement resetting
- Arithmetic operations
- Computing constant setting

Address switch setting
The 8-bit DIP switch on the rear panel enables the following settings.
- Selection of 31 machine addresses from 0 to 30
- Talk-only mode on/off
- Selection of delimiter between C/R, L/F and C/R L/F.



Highly-Stable Crystal Oscillators
(for SC-7204/SC-7104/SC-7102)

SC-0114 Specifications

Oscillation frequency	10 MHz
Aging rate	$\pm 5 \times 10^{-9}$/day, $+8 \times 10^{-8}$/year (reference: frequency 24 hrs after switching power on)
Temperature variation	$\pm 5 \times 10^{-8}$/0 to 40°C (32 to 104°F)
Rise characteristic	$\pm 5 \times 10^{-8}$ (10 min after seitching power on, with reference frequency at 1 hr after switching power on)

SC-0115 Specifications

Oscillation frequency	10 MHz
Aging rate	$\pm 2 \times 10^{-9}$/day, $\pm 5 \times 10^{-8}$/year (reference: frequency 24 hours after swtiching power on)
Temperature variation	$\pm 5 \times 10^{-8}$/0 to 40°C (32 to 104°F)
Rise characteristic	$\pm 5 \times 10^{-8}$ (10 min after switching power on, with reference frequency at 1 hr after switching power on)

SC-0108 Parallel Interface
(for SC-7201/SC-7104/SC-7103/SC-7102/SC-7101)

By incorporating the SC-0108 parallel interface in these counters, the following input/output functions are made available.

1. Data output

   20-byte ASCII codes are output using a Centronics-compatible 8-bit parallel, character serial interface. Measurement data can easily be printed by connecting any Centronics-type printer via a suitable connection cable such as the SX-0059. For cases in which signals with several-microsecond pulses are inconvenient, for example when reading data under the control of a personal computer using BASIC via the computer's parallel I/O port, the strobe signal line can be switched to a DC-level ready signal line so that a wider range of applications is possible.
   The number of data values per one print character can be selected between 1 — 4 using a switch on the rear panel.

2. Default setting selection

   Among the default measurement conditions that can be selected when switching power on, the following items can be selected using DIP switches on the rear panel.
   - Timebase
   - CHECK mode ON/OFF
   - Measuring function (SC-7201 only)
   - INPUT SELECT A/B (SC-7103/7104 only)

   This facility eliminates the need of setting the conditions each time power is switched on, and is specially useful when the counter is used exclusively in an inspection line, etc.

3. External resetting

   External reset signal can be input via the DATA OUT connector. The external reset signal is a negative pulse with a pulsewidth of more than 1 μs, with which resetting is recognized by the negative-going edge. The internal processing requires 500 μs to 1 ms between recognition and actual resetting. The input signal level is TTL-compatible. (CMOS 4049, 4050, 10 kΩ, PULL UP).

Connection Cable SX-0059
(for SC-0108/SC-0109)

36-pin plug connection cable for the SC-0108/0109 Parallel Interface. The length is 1.5 m (4.75 ft).
Signal lines from pins 1 to 12 and lines from pins 19 to 30 are paired and twisted (pins 1 and 19, pins 2 and 20, etc.).
Pin 17 is connected with the plug case and the cable's shield.

SC-0110 GP-IB Interface
(for SC-7201/SC-7104/SC-7103/SC-7102/SC-7101)

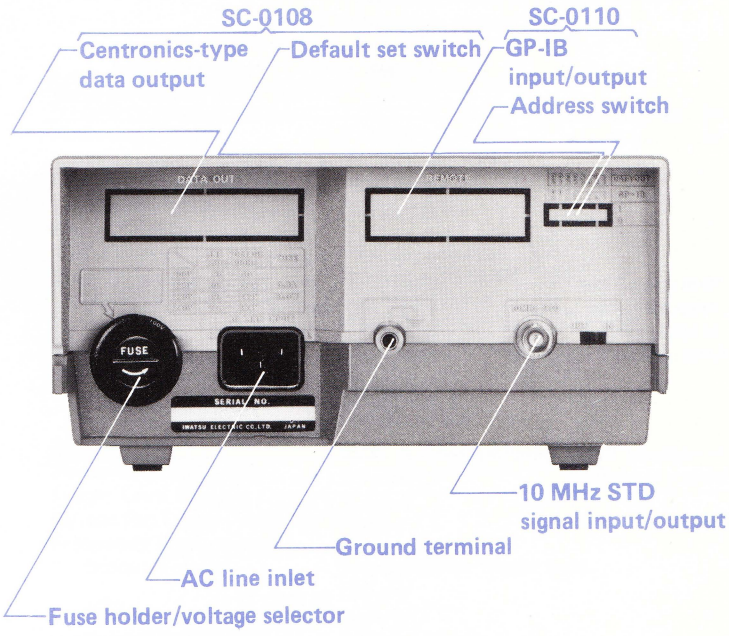
When incorporated in these counters, the SC-0110 makes possible the measurement resetting from an external controller, remote setting of timebase condition, input selection and DIFF operation, and external transmission of data.

- The electrical and mechanical ratings comply with IEEE Std. 488-1978.
- The subset functions are SH1, AH1, T5, L4, SR1, RL1, PP0, DC1, DT1 and C0.
- The remote/local status can be confirmed from an LED display on the front panel.

Remote control functions

	Measurement reset	Timebase RC	Input select RC	DIFF set
SC-7201	○	○	○	○
SC-7104 SC-7103	○	○	○	○
SC-7102 SC-7101	○	○	x	○

○ : Possible x : Not possible



*The counters can incorporate either the parallel or GP-IB interface but not both.

UNIVERSAL COUNTER SPECIFICATIONS

SC-7204/7203/7202 Common Specifications

Frequency Measurement I

Measurement Range : 1 mHz – 150 MHz (DC-coupled)
10 Hz – 150 MHz (AC-coupled)
1 kHz – 150 MHz (at 1 ms)
100 Hz – 150 MHz (at 10 ms)
10 Hz – 150 MHz (at 0.1 ms)
1 Hz – 150 MHz (at 1 s)
1 mHz – 150 MHz (at 10 s)

Input Voltage : Attenuator 1
25 mV – 1 Vrms (1 mHz – 80 MHz)
40 mV – 1 Vrms (80 MHz – 150 MHz)
Attenuator 1/20
0.5 V – 20 Vrms (1 mHz – 80 MHz)
0.8 V – 20 Vrms (80 MHz – 150 MHz)

Max. Input Voltage : 200 VDC + AC peak

Input RC : Approx. 1 MΩ, less than 30 pF parallel (SEP only)

Attenuators : 1, 1/20

Input Coupling : DC, AC

Trigger Levels : -1 V or less, - +1 V or more, preset (OV)

Measuring Time : 1 ms – 10 s (5 steps), external gate

Measuring Resolution : More than 10 MHz
1 kHz/1 ms, 100 Hz/10 ms, 10 Hz/
0.1 s/1 Hz/1 s, 0.1 Hz/10 s
Less than 10 MHz
4-digit/1 ms, 5-digit/10 ms,
6-digit/0.1 s 7-digit/1 s,
8-digit/10 s

Reading Unit : (EXP 0, ±3, ±6, ±9) Hz

Measurement Accuracy : More than 10 MHz
Precision of reference oscillator
±1 count
Less than 10 MHz
(Precision of reference oscillator)
$+\frac{\text{(Trigger error) ± (1 reference time)}}{\text{(Measuring frequency) x (Measuring time)}}$

Period Measurement

Measuring Range : 6.7 ns – 10^5 s
6.7 ns – 1 ms (1 ms)
6.7 ns – 10 ms (10 ms)
6.7 ns – 0.1 s (0.1 s)
6.7 ns – 1 s (1 s)
6.7 ns – 10^5 s (10 s)

Measuring Time : 1 ms – 10 s (5 steps), external gate

Measuring Resolution : 10 μs – 0.0001 ps

Reading Unit : (EXP 0, ±3, ±6, ±9) SEC

Measurement Accuracy : (Precision of reference oscillator)
+ (Measuring period)
$\times\frac{\text{(Trigger error) ± (1 reference time)}}{\text{(Measuring Time)}}$

Frequency Ratio Measurement

Measuring Range : f_1 Input 0.1 Hz – 150 MHz
f_2 Input 0.1 Hz – 16 MHz
f_2 : 1 kHz – 16 MHz (1 ms)
f_2 : 100 Hz – 16 MHz (10 ms)
10 Hz – 16 MHz (0.1 s)
1 Hz – 16 MHz (1 s)
0.1 Hz – 16 MHz (10 s)

Measuring Time : 1 ms – 10 s (5 step)

Reading Unit : (EXP 0, ±3, ±6, ±9)

Measurement Accuracy : $\frac{\text{(Trigger error of } f_2\text{)}}{\text{(Frequency of } f_2\text{) x (measuring time)}}$
± (1 count)

Frequency Margin Measurement

Measuring Range : f_1 Input 0.1 Hz – 150 MHz
f_2 Input 0.1 Hz – 16 MHz

Measurement Accuracy : f_2 : 1 kHz – 16 MHz (1 ms)
100 Hz – 16 MHz (10 ms)
10 Hz – 16 MHz (0.1 s)
1 Hz – 16 MHz (1 s)
0.1 Hz – 16 MHz (10 s)

Measuring Time : 1 ms – 10 s (5 steps)

Reading Unit : (EXP 0, ±3, ±6, ±9) Hz, prime numbers

Measurement Accuracy : $f_1 \leqq f_2$ or $f_2 \geqq 10$ MHz
$\frac{\text{(Trigger error of } f_2\text{)}}{\text{(Frezuency of } f_2\text{) x (measuring time)}}$
±(2 count)
$f_1 > f_2$
(Fomula above) $\pm\frac{\text{(Measuring time)}}{\text{(Frequency of } f_2\text{)}}$

Time Interval Measurement

Measuring Range : 100 ns – 10^5 s

Single Measurement : 100 ns – 10^5 s

Averaging Measurement : 100 ns – 5 s

Repeat Frequency in Averaging : 200 Hz or more (10 ms)
20 Hz or more (0.1 s)
2 Hz or more (1 s)
0.2 Hz or more (10 s)

Input Voltage : Attenuator 1
75 mVp-p – 3 Vp-p, max. ±1.5 V0-p
Attenuator 1/20
1.5 Vp-p – 60 Vp-p, max. 30 V0-p

Minimum Pulse Width : 30 ns

Max. Input Voltage : 200 VDC + AC peak

Input RC : Approx. 1 MΩ parallel 30 pF or less (SEP)
Approx. 500 kΩ parallel 60 pF or less (COM)

Attenuators : 1, 1/20

Input Coupling : DC, AC

Trigger Levels : -1 V or less – +1 V or more, preset (OV)

Measuring Time

Single Measurement : Set in 1 ms range

Averaging Measurement : 10 ms – 10 s (4 step)

Measuring Time

Single Measuremment : 100 ns Measuring times < 24
10 ns " > 25
1 ns " > 2500
100 ps " > 250000
10 ps " > 25000000

Stop-Inhibit Function : Inhibition for input of Stop signal

Inhibition Period : 200 μs or less – 20 ms or more

Reading Unit : (EXP 0, ±3, ±6, ±9) SEC

Measurement Accuracy : Precision of reference oscillator
± Trigger error ±1 reference time*±5 ns
*When there is no syncronized relationship between measured signal and reference time, the accuracy is reduced corresponding to the number of measuring times.

Additional Calculation Measurement

Calculation Analysis	: 6.67 ns
Input Voltage	: Attenuator 1 75 mp-p – 3 Vp-p, max. ±1.5 V0-p (DC – 80 MHz) 120 mVp-p – 3 Vp-p, max. ±1.5 V0-p (80 MHz – 150 MHz) Attenuator 1/20 1.5 Vp-p – 60 Vp-p, max. ±30 V0-p (DC – 80 MHz) 2.4 Vp-p – 60 Vp-p, max. ±30 V0-p (80 MHz – 150 MHz)
Minimum Pulse Width	: 3.3 ns
Calculation Capacity	: 999,999,999
Calculation Control	: OPEN/CLOSED switchable with manual switch or external gate
Reading Unit	: Prime number
Measurement Accuracy	: ±1 count on opening/closing the gate

External Gate Input

Frequency Range	: DC – 16 MHz
Input Voltage	: Attenuator 1 75 mVp-p – 3 Vp-p, max. ±1.5 V0-p Attenuator 1/20 1.5 Vp-p – 60 Vp-p, max. ±30 V0-p
Max. Input Voltage	: 200 V DC + AC peak
Input RC	: Approx. 1 MΩ parallel 30 pF less
Attenuators	: 1, 1/20
Input Coupling	: DC, AC
Trigger Levels	: -1 V or less – +1 V or more, preset (OV)
Polaritiy Selection	: +/- selectable

General

Processing Function	: DIFF Measurement difference between measured value and reference value X-X ref X : measuring value X ref : measuring value after manual reset MAX/MIN Measurement of maximum and minimum values Either max. or min. value display mode is possible. Also in measurement value display mode, max. or min. value can be recalled. COMP Digital comparator Upper and lower limit values can be set as 8-digit mantissa and 1-digit exponent. Indicates H/L for 10's digit mantissa. (X-A)/b Subtraction and division are possible. Both A and b constants can be set as a code +8-digit mantissa and 1-digit exponent.
Display Method	: Storage zero blanking method, LED display
Display Digits	: Mantissa 9-digit decimal Processing code +8-digit decimal, Exponent 0, ±3, ±6, ±9 Status 1-digit
3-digit Masking Display	: Lower 3-digit mantissa can be masked with 3-D MASK ON/OFF.
Display Time	: Measuring time + sample rate, Infinite display
Sample Rate	: 0.1 s – 999.9 s or 1 s – 9999 s, digital set
Reference Oscillator	: 10 MHz Specification depends on its specifications list.
Reference Frequency Output	: 10 MHz, 2 Vp-p or more More than 350 mVp-p at 50 Ω's end.
Reference Frequency Input	: 10 MHz, 1 V – 5 Vrms
Input Resistance	: Approx. 10 kΩ
Input Coupling	: AC
Output for Brightness Modulation	: TTL level, negative logic 350 mVp-p or moee at 50 Ω's end in time interval measurement (impossible during stop-inhibit)
Pre-heat Time	: More than 10 minutes
Environment for Use	: Temperature 0°C – +40°C Humidity 85 % RH or less (+40°C)
Environment for Storage	: Temperature -20°C – +70°C Humidity 90 % RH or less (+70°C)
Power Supply Voltage	: AC 100 V/120 V/220 V/240 V ±10 %
Power Supply Frequency	: 50 Hz – 400 Hz
Power Consumption	: Approx. 13 W SC-7202 Approx. 14.5 W SC-7203 Approx. 18.5 W SC-7204
Dimensions	: (260±2)W x (100±2)H x (310±2)L mm
Weight	: Approx. 3 kg
Accessories	: Power cord (1), Coaxial cords (3), Fuses (2), Envelope for accessories (1) Instruction manual (1)

SC-7204/7203 Common Specifications

Frequency measurement II

Measuring Range	: 50 MHz – 1.3 GHz
Input Voltage	: 25 mV – 1 Vrms
Max. Input Voltage	: 10 Vrms
Input Impedance	: Aprox. 50 Ω
Input Coupling	: AC
AGC Function	: Possible with AGC ON
Burst Signal Input	: Possible with BURST ON
Minimum Recess Time	: Less than 500 μs
Burst-hold Time	: Measuring time + 500 μs or more
Mesuring Time	: 2 ms – 20 s (5 step), external gate
Measuring Analysis	: 10 kHz/2 ms, 1 kHz/20 ms, 100 Hz/0.2 s 10 Hz/2 s, 1 Hz/20 s
Reading Unit	: (EXP 0, ±3, ±6, ±9) Hz
Measurement Accuracy	: Reference oscillator ±1 count

Trigger Level Monitor Output

Output for Trigger Level Monitor in Frequency Measurement I	
Output Voltage	: Set voltage for trigger level ±50 mV
Temperature Variation	: ±0.5 mV/°C
Output Resistance	: Approx. 10 kΩ

FREQUENCY COUNTER SPECIFICATIONS

SC-7104/7103/7102/7101 Specifications

	SC-7104/7102	SC-7103/7101
Frequency Measurement I	**(SC-7104 only)**	**(SC-7103 only)**
Measuring Range	1000 MHz/200 MHz	
Input Voltage	20 mV – 1 Vrms	
Max. Input Voltage	10 Vrms	
Input Impedance	Approx. 50 Ω	
Input Coupling	AC	
AGC Function	Possible with AGC switch On	
Burst Signal Measurement	Possible with BURST switch ON	
Min. Recess Time	Less than 500 μs	
Burst Keep Time	Measur. time + 500 μs or more	
Measuring Time	4 ms – 40 s (5 steps)	40 ms – 40 s (4 steps)
Measuring Resolution	1 kHz/4 ms, 100 Hz/40 ms, 10 Hz/4 s, 1 Hz/4 s, 0.1 Hz/40 s	100 Hz/40 ms, 10 Hz/0.4 s, 1 Hz/4 s, 0.1 Hz/40 s
Reading Unit	(EXP 0, ±3, ±6, ±9) Hz	
Measurement Accuracy	Precision of reference oscillator + 1 count	
Frequency Measurement II		
Measuring Range	10 Hz – 200 Hz	
Input Voltage	Attenuator 1 20 mV – 1 Vrms (1 kHz – 100 MHz) 50 mV – 1 Vrms (10 Hz – 200 MHz) Attenuator 1/20 0.4 V – 20 Vrms (1 kHz – 100 Hz) 1 V – 20 Vrms (10 Hz – 200 MHz)	
Max. Input Voltage	200 V DC + AC peak	
Input RC	Approx. 1 MΩ parallel 25 pF or less	
Attenuators	1, 1/20	
Input Coupling	AC	
Measuring Time	1 ms – 10 s (5 steps)	10 ms – 10 s (4 steps)
Measuring Resolution	More than 10 MHz 1 kHz/1 ms, 100 Hz/10 ms, 10 Hz/0.1 s, 1 Hz/1 s, 0.1 Hz/10 s Less than 10 MHz 4-digit/1 ms, 5-digit/10 ms, 6-digit/0.1 s, 7-digit/1 s, 8-digit/10 s	More than 10 MHz 100 MHz/10 ms, 10 Hz/0.1 s, 1 Hz/1 s, 0.1 Hz/10 s Less than 10 MHz 5-digit/10 ms, 6-digit/0.1 s, 7-digit/1 s, 8-digit/10 s
Reading Unit	(EXP 0, ±3, ±6, ±9) Hz	
Measurement Accuracy	More than 10 MHz Precision of ref. oscillator ±1 count Less than 10 MHz (Precision of ref. oscillator) + (trigger accuracy) ± (1 ref. time)/(measur. freq.) x (measur. time)	

	SC-7104/7102	SC-7103/SC-7101
General Specifications		
Processing Function	DIFF: X – X ref X: measuring value X ref : measur. value after manual reset	
Display Method	Storage zero blanking method LED display	
Displays	Mantissa 9-digit decimal code + 8-digit decimal (processing) Exponent 0, ±3, ±6, ±9	
Display Time	Measuring time + sample rate Infinite display	
Sample Rate	Approx. 200 ms, x2, x4, x8 (4 steps)	Approx. 200 ms
Reference Oscillator Aging Rate	10 MHz $\pm 2 \times 10^{-8}$/day $\pm 10 \times 10^{-8}$/year (24 H after is supplied)	10 MHz $\pm 3 \times 10^{-7}$/month $\pm 10 \times 10^{-7}$/year (1 H after power is supplied)
Rising Characteristics	$\pm 5 \times 10^{-8}$ (From 10 minutes after, referring 1 H after power is supplied)	$\pm 3 \times 10^{-6}$ (From 10 minutes after, referring 1 H after power is supplied)
Temperature Variation	$\pm 5 \times 10^{-8}$/0°C – +40°C	$\pm 3 \times 10^{-6}$/0°C – + 40°C
Reference Freq. Output Output Amplitude	10 MHz 2 Vp-p or more (open voltage) 350 mVp-p or more (50 Ω end)	
Reference Freq. Input Input Voltage	10 MHz 1 V – 5 Vrms	
Input Resistance	Approx. 10 k (AC-coupled)	
Pre-Heat Time	More than 10 min. No necessary	
Environment for Use	Temperature 0°C – +40°C Humidity 85 % RH or less (+70°C)	
Environment for Storage	Temperature -20°C – +70°C Humidity 90 % RH or less (+70°C)	
Power Supply Voltage	AC 100 V /120 V/220 V/240 V ±10 %	
Power Supply Frequency	50 Hz – 400 Hz	
Power Consumption	Approx. 16.5 W (SC-7104) Approx. 15 W (SC-7102)	Approx. 12.5 W (SC-7103) Approx. 11 W (SC-7101)
Dimensions	(210±2)W x (100±2)H x (310±2)L mm (8-3/8" x 4" x 12-1/4")	
Weight	Approx. 2.5 kg (5.5 lbs)	
Accessories	Power cord (1), Coaxial cord (1), Fuse (2), Accessoreis envelope (1), Instruction manual (1)	

Specifications are subject to change without notice.

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